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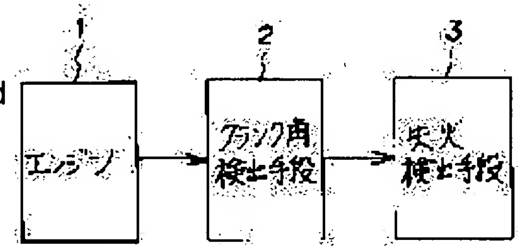
(54) MISFIRE DETECTING DEVICE OF INTERNAL COMBUSTION ENGINE

(57)Abstract:

PURPOSE: To make a correct judgement of the misfire over the extensive operational range of an engine, with a simple constitution.

CONSTITUTION: The high level interval and the low level interval of the reference periodical pulse to give the position of the crank angle according to the ignition timing of a 6-cylinder engine 1 are measured by a crank angle detecting means 2, the required time for the specified angle range below and over the reference speed of the crank angle is calculated from the measured value by a misfire detecting means 3, and a judgement on the misfire is made from the calculated value. Thus, it is unnecessary to add a sensor, leading to a simplified and inexpensive constitution with high accuracy, and normalization of the load fluctuation of the engine.



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CLAIMS

[Claim(s)]
[Claim 1] Flame-failure detection equipment of the internal combustion engine having a means to compute the duration of the predetermined include-angle section before and after inserting the criteria include angle of said crank angle from the measurement value measured with a crank angle detection means to measure the high-level period and low-level period of the criteria period pulse signal which gives the crank angle location corresponding to the ignition timing of a six cylinder engine, and this crank angle detection means, and to judge a flame failure by this calculation result.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the flame-failure detection equipment of the internal combustion engine for detecting the flame failure by abnormalities, such as an internal combustion engine's ignition system and a fuel system.
[0002]
[Description of the Prior Art] Conventionally, there are some which are indicated by JP,62-26345,A as this kind of equipment. This detects engine cylinder internal pressure by the cylinder internal pressure sensor, searches for the crank angle from which this cylinder internal pressure serves as a peak, and when this peak location exists within the crank angle period defined beforehand, it judges that it is normal.
[0003]
[Problem(s) to be Solved by the Invention] However, such conventionally, in order to detect the peak location of cylinder internal pressure, by the light load service condition, it needed to continue for every crank angle per predetermined period, cylinder internal pressure needed to be measured, equipment became complicated, and a compression top dead center, and those of the peak according [the peak value of cylinder internal pressure] to combustion with two kind and its judgment were difficult for equipment, and when it had a peak in front of a compression top dead center, it had the technical problem of being unable to perform a flame failure judging.
[0004] This invention was made in order to cancel such a conventional technical problem, and it aims at obtaining the flame-failure detection equipment of the internal combustion engine which enables an exact flame-failure judging by the wide range engine operating range by the comparatively easy configuration.
[0005]
[Means for Solving the Problem] The flame-failure detection equipment of the internal combustion engine concerning this invention establishes a flame-failure detection means by which use a crank angle criteria periodic signal, detect the duration ratio of the section whenever [predetermined crank angle / which divides each one period before and after inserting the specific criteria include angle of a six cylinder engine], and the flame failure was detected from this time amount ratio.
[0006]
[Function] The flame-failure detection equipment in this invention detects the above-mentioned time amount ratio which changes with existence of a flame failure, and judges a flame failure from the difference of this ratio, or the acceleration of a ratio.
[0007]
[Example] Hereafter, the example of the flame-failure detection equipment of the internal combustion engine of this invention is explained about drawing. Drawing 1 is the functional block diagram of the one example. In this drawing 1 , a crank angle detection means to output the criteria crank angle location which uses 1 for an engine and uses 2 for ignition control, and 3 are flame-failure detection means, and are a flame-failure detection means to judge a flame failure from the acceleration of the time amount ratio of a criteria periodic signal before and after inserting the specific criteria include angle of an engine 1, for example, a top dead center, from the signal of the crank angle detection means 2, or the above-mentioned time amount ratio.
[0008] Drawing 2 is the block diagram showing the configuration of the concrete example constituted with the application of this invention. In this drawing 2 , it connects with the crankshaft or cam shaft of an engine 1, and the engine with which 1 has the gas columns 21-26 of #1-#6, and 6 are crank angle sensors which output a periodic signal for every (120 degrees) criteria location of the crank angle corresponding to the ignition location of gas columns 2-5,

and correspond to the crank angle detection means 2 of drawing 1 .

[0009] Moreover, 7 undergoes the output of the crank angle sensor 6, is a flame-failure detecting element which detects a flame failure, and is constituted by the interface 8 which transmits the signal of the crank angle sensor 6 to a microcomputer 9 (it is called a microcomputer for short below), the memory 10 which memorizes procedure and control information, the timer counter (free-running counter) 11 counted up for every clock during scheduled time, and the microcomputer 9 which contained the CPU12 grade which performs flame-failure detection data processing. In the above-mentioned configuration, the signal of the crank angle sensor 6 is inputted into a microcomputer 9 through an interface 8, and data processing is performed.

[0010] Next, the example of drawing 3 explains actuation of this invention. The pressure variation of each gas columns 21-26 and the wave of each part over the crank angle of 4 stroke cycle six cylinder engine are shown in drawing 3 (a) and drawing 3 (b). drawing 3 (a) -- setting -- a continuous line -- the 1st of an engine 1 -- it is the pressure wave form of cylinder #1, and BDC is a bottom dead point and TDC is a top dead center. moreover, a broken line -- the 3rd -- cylinder #3 and an alternate long and short dash line -- the 2nd -- cylinder #2 and a two-dot chain line -- the 4th -- it is the pressure wave form of cylinder #4.

[0011] As shown in this drawing 3 (a), in the six cylinder engine, the combustion cycle of each gas column has the phase contrast of 120 crank angles. In addition, the pressure wave form of #2, #3, #4, #5, and #6 indicates a chisel like compression and an explosion line, and the stroke of inhalation and exhaust air is omitting the publication.

[0012] As shown in drawing 3 (b), the crank angle sensor 6 6 degree [of signals in a cycle of 120 degrees] B Falls corresponding to the ignition timing of each gas columns 21-26, and outputs the signal of 76 degreeB standup. As backup in order that this may raise the control precision of ignition timing control need range [of 60 degrees] B-20-degreeA in order to also carry out ignition timing control on these signal criteria, when 76degreeB which is a location near 60 degreeB of a control top maximum tooth lead angle, and the computer for control break down, in order to secure ignition timing, the signal of 6 degreeB is used.

[0013] Like drawing 3 (b), the periodic signal which was able to be distributed to the low-level section (Following L is called) of 50 degrees and the high-level section (Following H is called) of 70 degrees with the period of 120 degrees on the basis of the location of 6 times ago is generated as opposed to TDC.

[0014] Generally, ignition control controls energization of the ignition coil which is not illustrated here with reference to this signal. namely, the 1st -- if cylinder #1 is taken for an example, energization of an ignition coil will be started at H section of a compression stroke, energization of an ignition coil will be intercepted with reference to the signal of the crank angle sensor 6 which changes from H to L near the TDC at the ignition timing set corresponding to the rotational frequency load, and the high voltage generated by this will be impressed and lit to an ignition plug.

[0015] Corresponding to this, as a continuous line shows to drawing 3 (a), cylinder internal pressure lights like zero crank angle thru/or the explosion line in 720 degrees, and a firing pressure increases. Like the following, an order of ignition is repeated a period 120 degrees, and a combustion cycle is repeated in order of #1 ->#2 ->#3 ->#4 ->#5 -># 6-cylinder.

[0016] Next, the concrete approach of flame-failure detection is explained. The relation between combustion and each include angle is shown in drawing 3 (a) and drawing 3 (c). In addition, this drawing 3 is engine-speed 1000rpm. It is a case.

[0017] the 1st shown in drawing 3 (a) as a continuous line -- in cylinder #1, the wave centering on zero crank angle is the case of normal combustion, and the gaseous mixture filled up with the charging stroke is pressurized by the compression stroke, is lit near compressive TDC, expands rapidly like an explosion line, and is discharged out of a gas column like an exhaust air line.

[0018] Next, an ignition failure or air, and the flame-failure condition generated when the mixing ratio of a fuel is unsuitable are explained. The pressure wave form centering on 720 crank angles is equivalent to this, and serves as bilateral symmetry focusing on TDC. When there is no combustion in the case of this example, the condition of a perfect flame failure is shown, but if extent of a flame failure is slight, the pressure transition like an explosion line will serve as a middle value of the pressure wave form of forward always shown in 360 crank angles thru/or 480 degrees.

[0019] Moreover, angular velocity increases corresponding to the torque rise by explosion of each gas column, and angular velocity has the property which decreases corresponding to compression, as shown in the crank angle 0 of drawing 3 (c) thru/or 720 degrees.

[0020] Here, since the torque rise by explosion will not be acquired as shown after 720 crank angles if a flame failure occurs, angular velocity decreases, and it continues decreasing until the following explosion of gas column #2 occurs.

[0021] Then, this invention tends to judge a flame failure paying attention to this from fluctuation of the angular velocity of the predetermined section of the crank angle generated by the existence of a flame failure. Drawing 4 is the

timing diagram of data processing of the microcomputer 9 by the 1st example of this invention, and drawing 5 is a flow chart which shows the operation flow of this microcomputer 9. This example measures the ignition periodic signal of the crank angle sensor 6, for example, the duration of the L section TU of 50 degrees which faces across the H sections TL and TDC of 70 crank angles before 6 times in front of the top dead center TDC shown in drawing 3 (b), and detects a flame failure from that measurement result.

[0022] As the detail timing diagram of the crank angle sensor 6 and data processing is shown in drawing 4 , on the basis of a top dead center TDC, with the signal of the crank angle sensor 6, an interrupt occurs on a microcomputer 9 through an interface 8, the flow of drawing 5 is performed by every before [a top dead center] 76 degree (it is described as the 76 followings BTDC) as an interrupt handler, and the flow of drawing 6 is performed at every before [a top dead center] 6 degree (it is described as the six followings BTDC).

[0023] First, in drawing 5 , CPU12 is stored in the memory MB76 which read the counter value of the timer counter 11 counted up for every predetermined time clock at step S1, and was prepared in memory 10. Here, this stored value shows the time of day in 76 BTDC(s).

[0024] Next, it moves to step S2 and this processing judges with reference to the flag which does not illustrate whether it is the 2nd less than time from the start time of a program. It is this flag at the start time of a program, it is set so that the 2nd less than time may be shown, and in this case, it branches to YES while it clears this flag, and it ends processing.

[0025] Next, CPU12 stands by until the signal of the crank angle sensor 6 is set to six BTDC(s). An engine rotates, if it reaches at the time of six BTDC(s) shown in drawing 4 , it will generate in interruption again with the signal of the crank angle sensor 6, and the flow of drawing 6 R> 6 will be performed. In this drawing 6 , at step S7, the counter value of a timer counter 11 is read and the value which shows the time of day in six BTDC(s) is stored in memory MB6.

[0026] Subsequently, duration of the section TL shown in drawing 4 with reference to the time of day in 76 BTDC(s) given at step S1 of drawing 5 by step S8 TL=MB76-MB6 ... (1)

It is TLO of memory 10 about the duration TL which boiled, computed more and was computed last time. After storing, the duration computed by (1) formula is stored in TL of memory 10, and processing is ended.

[0027] Subsequently, if the location of 76 BTDC(s) corresponding to the ignition signal of the following gas column is arrived at, processing of drawing 5 will be performed again. Here, in step S2, while updating the value of memory MB76 and preparing for next processing at step S1, since the initial flag is cleared by the last processing, it moves to step S3.

[0028] The section TU shown in drawing 4 at step S3 with reference to the time of day in BTDC6" given at step S7 of drawing 6 Duration TU =MB6-MB76 ... (2)

It is alike, computes more and, subsequently is a time amount ratio. TU+TL/2/TLO ... (3)

It is alike and computes more.

[0029] As mentioned above, the include angle of 76degreeB of a crank angle sensor output and 6 degreeB is required of another reason. With the velocity ratio of the crank shaft revolution speed of a compression stroke, and the crank shaft revolution speed like an explosion line, by this invention that is going to judge a flame failure Since it will be set to 44 degreeA from 6degreeB and the measurement section of an on the way (below one half) like an explosion line will come when the measurement section sees in the same gas column if the L period TU (50-degreeCA period) of said measured crank angle signal output is used as it is, in this example as the measurement section like an explosion line TU+LL/2=50+70/2=85CA ... (4)

It chose.

[0030] In order to raise speed detection precision, it is so advantageous that the measurement section is long. However, in a 6-cylinder case, although more than 90-degreeeach CA is possible for the measurement section like a compression stroke and an explosion line like a 4-cylinder about that by which each stroke of each gas column is carried out independently for every 180-degreeCA, since ignition is performed for every 120-degreeCA, it becomes easy to be combustion influenced of a contiguity gas column. Then, it will be necessary to set the crankshaft tachography section like an explosion line to 85-degreeCA like a formula (3) like this example, and to take the method with which the measurement section also overlaps 2 cylinder.

[0031] Next, it judges with judging, and branching and carrying out the flame failure of whether this time amount ratio is larger than the predetermined value corresponding to the flame failure set up beforehand to step S5 by step S4, when that judgment result is large. Moreover, if a time amount ratio is smaller than a predetermined value as a result of the judgment by step S4, processing will branch from the NO side of step S4 to step S6, it will judge with it being normal at this step S6, and processing will be ended, respectively.

[0032] Hereafter, similarly, in the flow of drawing 5 R> 5, by six BTDC(s), the flow of drawing 6 is performed and sequential calculation of the time amount ratio corresponding to each gas column is carried out at 76 BTDC(s).
[0033] drawing (d) -- a flame failure and the time amount ratio TU -- +TL/2/TLO It is drawing showing(%) of relation. this drawing -- setting -- a continuous line -- each, if it is set as the flame-failure decision value which is a time amount ratio value computed corresponding to gas column #1-#4, respectively, shows in this drawing with a broken line, for example, uses the value of 158 (%) by step S4 of drawing 5 It corresponds to the flame failure of gas column #1 centering on 720 crank angles, and is time amount ratio TU+TL/2-/TL0. Since it increases and becomes beyond a predetermined value, it is clear that a flame failure can be judged.
[0034]
[Effect of the Invention] According to this invention, the rotation fluctuation by the flame failure as mentioned above, by measuring the high-level period of the criteria periodic signal of a crank angle sensor, and a low-level period Since it constituted so that the duration ratio of the section might be computed whenever [crank angle / which represents like a compression stroke and an explosion line before and after inserting the specific criteria include angle of each gas column] and a flame failure might be detected from this time amount ratio Detection sensitivity is good and it is effective in the crank angle sensor moreover used for ignition control being used, not forming a sensor specially, and equipment being cheaply made with an easy configuration, and what has a high precision being obtained.
[0035] Moreover, since the time amount ratio was constituted so that it might ** by the time amount based on a compression stroke, it has the description which can normalize an engine load effect.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Industrial Application] This invention relates to the flame-failure detection equipment of the internal combustion engine for detecting the flame failure by abnormalities, such as an internal combustion engine's ignition system and a fuel system.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, there are some which are indicated by JP,62-26345,A as this kind of equipment. This detects engine cylinder internal pressure by the cylinder internal pressure sensor, searches for the crank angle from which this cylinder internal pressure serves as a peak, and when this peak location exists within the crank angle period defined beforehand, it judges that it is normal.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the rotation fluctuation by the flame failure as mentioned above, by measuring the high-level period of the criteria periodic signal of a crank angle sensor, and a low-level period Since it constituted so that the duration ratio of the section might be computed whenever [crank angle / which represents like a compression stroke and an explosion line before and after inserting the specific criteria include angle of each gas column] and a flame failure might be detected from this time amount ratio Detection sensitivity is good and it is effective in the crank angle sensor moreover used for ignition control being used, not forming a sensor specially, and equipment being cheaply made with an easy configuration, and what has a high precision being obtained.
[0035] Moreover, since the time amount ratio was constituted so that it might ** by the time amount based on a compression stroke, it has the description which can normalize an engine load effect.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, such conventionally, in order to detect the peak location of cylinder internal pressure, by the light load service condition, it needed to continue for every crank angle per predetermined period, cylinder internal pressure needed to be measured, equipment became complicated, and a compression top dead center, and those of the peak according [the peak value of cylinder internal pressure] to combustion with two kind and its judgment were difficult for equipment, and when it had a peak in front of a compression top dead center, it had the technical problem of being unable to perform a flame failure judging.
[0004] This invention was made in order to cancel such a conventional technical problem, and it aims at obtaining the flame-failure detection equipment of the internal combustion engine which enables an exact flame-failure judging by the wide range engine operating range by the comparatively easy configuration.

[Translation done.]

MEANS

[Means for Solving the Problem] The flame-failure detection equipment of the internal combustion engine concerning this invention establishes a flame-failure detection means by which use a crank angle criteria periodic signal, detect the duration ratio of the section whenever [predetermined crank angle / which divides each one period before and after inserting the specific criteria include angle of a six cylinder engine], and the flame failure was detected from this time amount ratio.

[Translation done.]

* NOTICES *

OPERATION

[Function] The flame-failure detection equipment in this invention detects the above-mentioned time amount ratio which changes with existence of a flame failure, and judges a flame failure from the difference of this ratio, or the acceleration of a ratio.

[Translation done.]

EXAMPLE

[Example] Hereafter, the example of the flame-failure detection equipment of the internal combustion engine of this invention is explained about drawing. Drawing 1 is the functional block diagram of the one example. In this drawing 1 , a crank angle detection means to output the criteria crank angle location which uses 1 for an engine and uses 2 for ignition control, and 3 are flame-failure detection means, and are a flame-failure detection means to judge a flame failure from the acceleration of the time amount ratio of a criteria periodic signal before and after inserting the specific criteria include angle of an engine 1, for example, a top dead center, from the signal of the crank angle detection means 2, or the above-mentioned time amount ratio.
[0008] Drawing 2 is the block diagram showing the configuration of the concrete example constituted with the application of this invention. In this drawing 2 , it connects with the crankshaft or cam shaft of an engine 1, and the engine with which 1 has the gas columns 21-26 of #1-#6, and 6 are crank angle sensors which output a periodic signal for every (120 degrees) criteria location of the crank angle corresponding to the ignition location of gas columns 2-5, and correspond to the crank angle detection means 2 of drawing 1 .
[0009] Moreover, 7 undergoes the output of the crank angle sensor 6, is a flame-failure detecting element which detects a flame failure, and is constituted by the interface 8 which transmits the signal of the crank angle sensor 6 to a microcomputer 9 (it is called a microcomputer for short below), the memory 10 which memorizes procedure and control information, the timer counter (free-running counter) 11 counted up for every clock during scheduled time, and the microcomputer 9 which contained the CPU12 grade which performs flame-failure detection data processing. In the above-mentioned configuration, the signal of the crank angle sensor 6 is inputted into a microcomputer 9 through an interface 8, and data processing is performed.
[0010] Next, the example of drawing 3 explains actuation of this invention. The pressure variation of each gas columns 21-26 and the wave of each part over the crank angle of 4 stroke cycle six cylinder engine are shown in drawing 3 (a) and drawing 3 (b). drawing 3 (a) -- setting -- a continuous line -- the 1st of an engine 1 -- it is the pressure wave form of cylinder #1, and BDC is a bottom dead point and TDC is a top dead center. moreover, a broken line -- the 3rd -- cylinder #3 and an alternate long and short dash line -- the 2nd -- cylinder #2 and a two-dot chain line -- the 4th -- it is the pressure wave form of cylinder #4.
[0011] As shown in this drawing 3 (a), in the six cylinder engine, the combustion cycle of each gas column has the phase contrast of 120 crank angles. In addition, the pressure wave form of #2, #3, #4, #5, and #6 indicates a chisel like compression and an explosion line, and the stroke of inhalation and exhaust air is omitting the publication.
[0012] As shown in drawing 3 (b), the crank angle sensor 6 6 degree [of signals in a cycle of 120 degrees] B Falls corresponding to the ignition timing of each gas columns 21-26, and outputs the signal of 76 degreeB standup. As backup in order that this may raise the control precision of ignition timing control need range [of 60 degrees] B-20-degreeA in order to also carry out ignition timing control on these signal criteria, when 76degreeB which is a location near 60 degreeB of a control top maximum tooth lead angle, and the computer for control break down, in order to secure ignition timing, the signal of 6 degreeB is used.
[0013] Like drawing 3 (b), the periodic signal which was able to be distributed to the low-level section (Following L is called) of 50 degrees and the high-level section (Following H is called) of 70 degrees with the period of 120 degrees on the basis of the location of 6 times ago is generated as opposed to TDC.
[0014] Generally, ignition control controls energization of the ignition coil which is not illustrated here with reference to this signal. namely, the 1st -- if cylinder #1 is taken for an example, energization of an ignition coil will be started at H section of a compression stroke, energization of an ignition coil will be intercepted with reference to the signal of the crank angle sensor 6 which changes from H to L near the TDC at the ignition timing set corresponding to the rotational frequency load, and the high voltage generated by this will be impressed and lit to an ignition plug.

[0015] Corresponding to this, as a continuous line shows to drawing 3 (a), cylinder internal pressure lights like zero crank angle thru/or the explosion line in 720 degrees, and a firing pressure increases. Like the following, an order of ignition is repeated a period 120 degrees, and a combustion cycle is repeated in order of #1 ->#2 ->#3 ->#4 ->#5 -># 6-cylinder.
[0016] Next, the concrete approach of flame-failure detection is explained. The relation between combustion and each include angle is shown in drawing 3 (a) and drawing 3 (c). In addition, this drawing 3 is engine-speed 1000rpm. It is a case.
[0017] the 1st shown in drawing 3 (a) as a continuous line -- in cylinder #1, the wave centering on zero crank angle is the case of normal combustion, and the gaseous mixture filled up with the charging stroke is pressurized by the compression stroke, is lit near compressive TDC, expands rapidly like an explosion line, and is discharged out of a gas column like an exhaust air line.
[0018] Next, an ignition failure or air, and the flame-failure condition generated when the mixing ratio of a fuel is unsuitable are explained. The pressure wave form centering on 720 crank angles is equivalent to this, and serves as bilateral symmetry focusing on TDC. When there is no combustion in the case of this example, the condition of a perfect flame failure is shown, but if extent of a flame failure is slight, the pressure transition like an explosion line will serve as a middle value of the pressure wave form of forward always shown in 360 crank angles thru/or 480 degrees.
[0019] Moreover, angular velocity increases corresponding to the torque rise by explosion of each gas column, and angular velocity has the property which decreases corresponding to compression, as shown in the crank angle 0 of drawing 3 (c) thru/or 720 degrees.
[0020] Here, since the torque rise by explosion will not be acquired as shown after 720 crank angles if a flame failure occurs, angular velocity decreases, and it continues decreasing until the following explosion of gas column #2 occurs.
[0021] Then, this invention tends to judge a flame failure paying attention to this from fluctuation of the angular velocity of the predetermined section of the crank angle generated by the existence of a flame failure. Drawing 4 is the timing diagram of data processing of the microcomputer 9 by the 1st example of this invention, and drawing 5 is a flow chart which shows the operation flow of this microcomputer 9. This example measures the ignition periodic signal of the crank angle sensor 6, for example, the duration of the L section TU of 50 degrees which faces across the H sections TL and TDC of 70 crank angles before 6 times in front of the top dead center TDC shown in drawing 3 (b), and detects a flame failure from that measurement result.
[0022] As the detail timing diagram of the crank angle sensor 6 and data processing is shown in drawing 4 , on the basis of a top dead center TDC, with the signal of the crank angle sensor 6, an interrupt occurs on a microcomputer 9 through an interface 8, the flow of drawing 5 is performed by every before [a top dead center] 76 degree (it is described as the 76 followings BTDC) as an interrupt handler, and the flow of drawing 6 is performed at every before [a top dead center] 6 degree (it is described as the six followings BTDC).
[0023] First, in drawing 5 , CPU12 is stored in the memory MB76 which read the counter value of the timer counter 11 counted up for every predetermined time clock at step S1, and was prepared in memory 10. Here, this stored value shows the time of day in 76 BTDC(s).
[0024] Next, it moves to step S2 and this processing judges with reference to the flag which does not illustrate whether it is the 2nd less than time from the start time of a program. It is this flag at the start time of a program, it is set so that the 2nd less than time may be shown, and in this case, it branches to YES while it clears this flag, and it ends processing.
[0025] Next, CPU12 stands by until the signal of the crank angle sensor 6 is set to six BTDC(s). An engine rotates, if it reaches at the time of six BTDC(s) shown in drawing 4 , it will generate in interruption again with the signal of the crank angle sensor 6, and the flow of drawing 6 R> 6 will be performed. In this drawing 6 , at step S7, the counter value of a timer counter 11 is read and the value which shows the time of day in six BTDC(s) is stored in memory MB6.
[0026] Subsequently, duration of the section TL shown in drawing 4 with reference to the time of day in 76 BTDC(s) given at step S1 of drawing 5 by step S8 TL=MB76-MB6 ... (1)
It is TLO of memory 10 about the duration TL which boiled, computed more and was computed last time. After storing, the duration computed by (1) formula is stored in TL of memory 10, and processing is ended.
[0027] Subsequently, if the location of 76 BTDC(s) corresponding to the ignition signal of the following gas column is arrived at, processing of drawing 5 will be performed again. Here, in step S2, while updating the value of memory MB76 and preparing for next processing at step S1, since the initial flag is cleared by the last processing, it moves to step S3.
[0028] The section TU shown in drawing 4 at step S3 with reference to the time of day in BTDC6" given at step S7 of

drawing 6 Duration TU =MB6-MB76 ... (2)
It is alike, computes more and, subsequently is a time amount ratio. TU+TL/2/TLO ... (3)
It is alike and computes more.
[0029] As mentioned above, the include angle of 76degreeB of a crank angle sensor output and 6 degreeB is required of another reason. With the velocity ratio of the crank shaft revolution speed of a compression stroke, and the crank shaft revolution speed like an explosion line, by this invention that is going to judge a flame failure Since it will be set to 44 degreeA from 6degreeB and the measurement section of an on the way (below one half) like an explosion line will come when the measurement section sees in the same gas column if the L period TU (50-degreeCA period) of said measured crank angle signal output is used as it is, in this example as the measurement section like an explosion line TU+LL/2=50+70/2=85CA ... (4)
It chose.
[0030] In order to raise speed detection precision, it is so advantageous that the measurement section is long. However, in a 6-cylinder case, although more than 90-degreeeach CA is possible for the measurement section like a compression stroke and an explosion line like a 4-cylinder about that by which each stroke of each gas column is carried out independently for every 180-degreeCA, since ignition is performed for every 120-degreeCA, it becomes easy to be combustion influenced of a contiguity gas column. Then, it will be necessary to set the crankshaft tachography section like an explosion line to 85-degreeCA like a formula (3) like this example, and to take the method with which the measurement section also overlaps 2 cylinder.
[0031] Next, it judges with judging, and branching and carrying out the flame failure of whether this time amount ratio is larger than the predetermined value corresponding to the flame failure set up beforehand to step S5 by step S4, when that judgment result is large. Moreover, if a time amount ratio is smaller than a predetermined value as a result of the judgment by step S4, processing will branch from the NO side of step S4 to step S6, it will judge with it being normal at this step S6, and processing will be ended, respectively.
[0032] Hereafter, similarly, in the flow of drawing 5 R> 5, by six BTDC(s), the flow of drawing 6 is performed and sequential calculation of the time amount ratio corresponding to each gas column is carried out at 76 BTDC(s).
[0033] drawing (d) -- a flame failure and the time amount ratio TU -- +TL/2/TLO It is drawing showing(%) of relation. this drawing -- setting -- a continuous line -- each, if it is set as the flame-failure decision value which is a time amount ratio value computed corresponding to gas column #1-#4, respectively, shows in this drawing with a broken line, for example, uses the value of 158 (%) by step S4 of drawing 5 It corresponds to the flame failure of gas column #1 centering on 720 crank angles, and is time amount ratio TU+TL/2-/TL0. Since it increases and becomes beyond a predetermined value, it is clear that a flame failure can be judged.

[Translation done.]

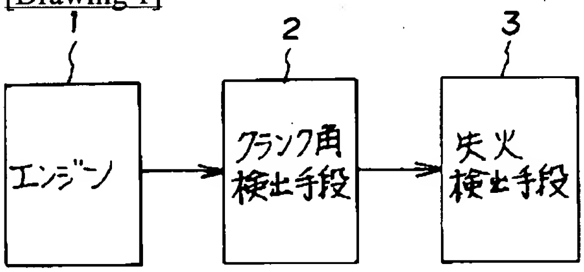
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the functional block diagram showing the configuration of the flame-failure detection equipment of the internal combustion engine by one example of this invention.
[Drawing 2] It is the block diagram showing the configuration of the flame-failure detection equipment of the internal combustion engine by the concrete example of this invention.
[Drawing 3] It is a timing diagram for explaining actuation of the example of drawing 2 same as the above.
[Drawing 4] It is the timing diagram of data processing of the microcomputer in the example of drawing 2 same as the above.
[Drawing 5] It is the flow chart which shows the operation flow for every BTDC76" of the microcomputer in the example of drawing 2 same as the above.
[Drawing 6] It is the flow chart which shows the operation flow for every BTDC6" of the microcomputer in the example of drawing 2 same as the above.
[Description of Notations]
1 Engine
2 Crank Angle Detection Means
3 Flame-Failure Detection Means
21 Gas Column
22 Gas Column
23 Gas Column
24 Gas Column
25 Gas Column
26 Gas Column
6 Crank Angle Sensor
7 Flame-Failure Detecting Element
8 Interface
9 Microcomputer
10 Memory
11 Timer Counter
12 CPU

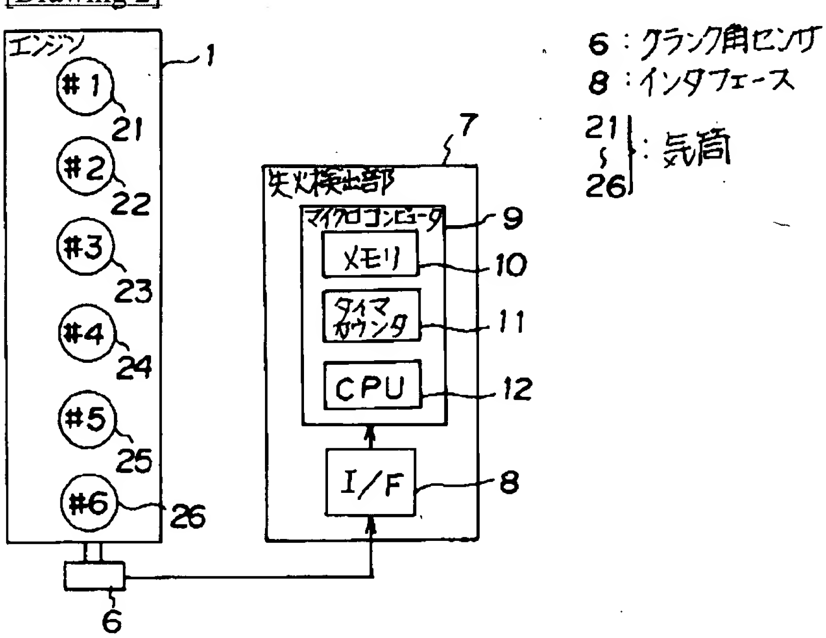
[Translation done.]

DRAWINGS

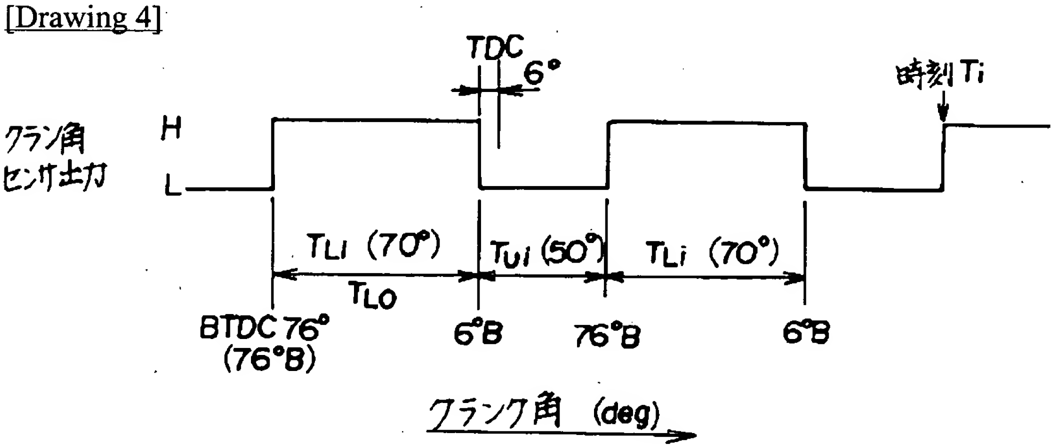
[Drawing 1]



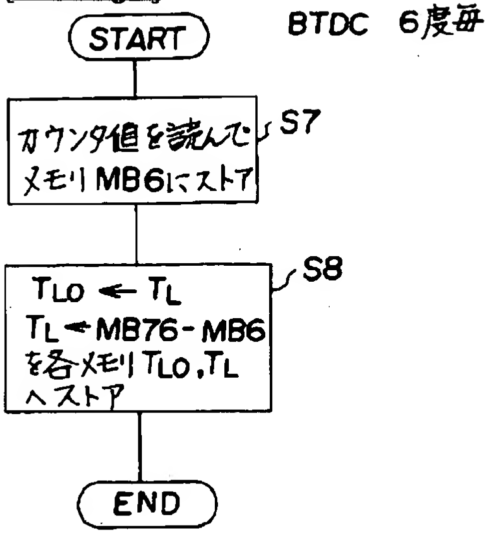
[Drawing 2]



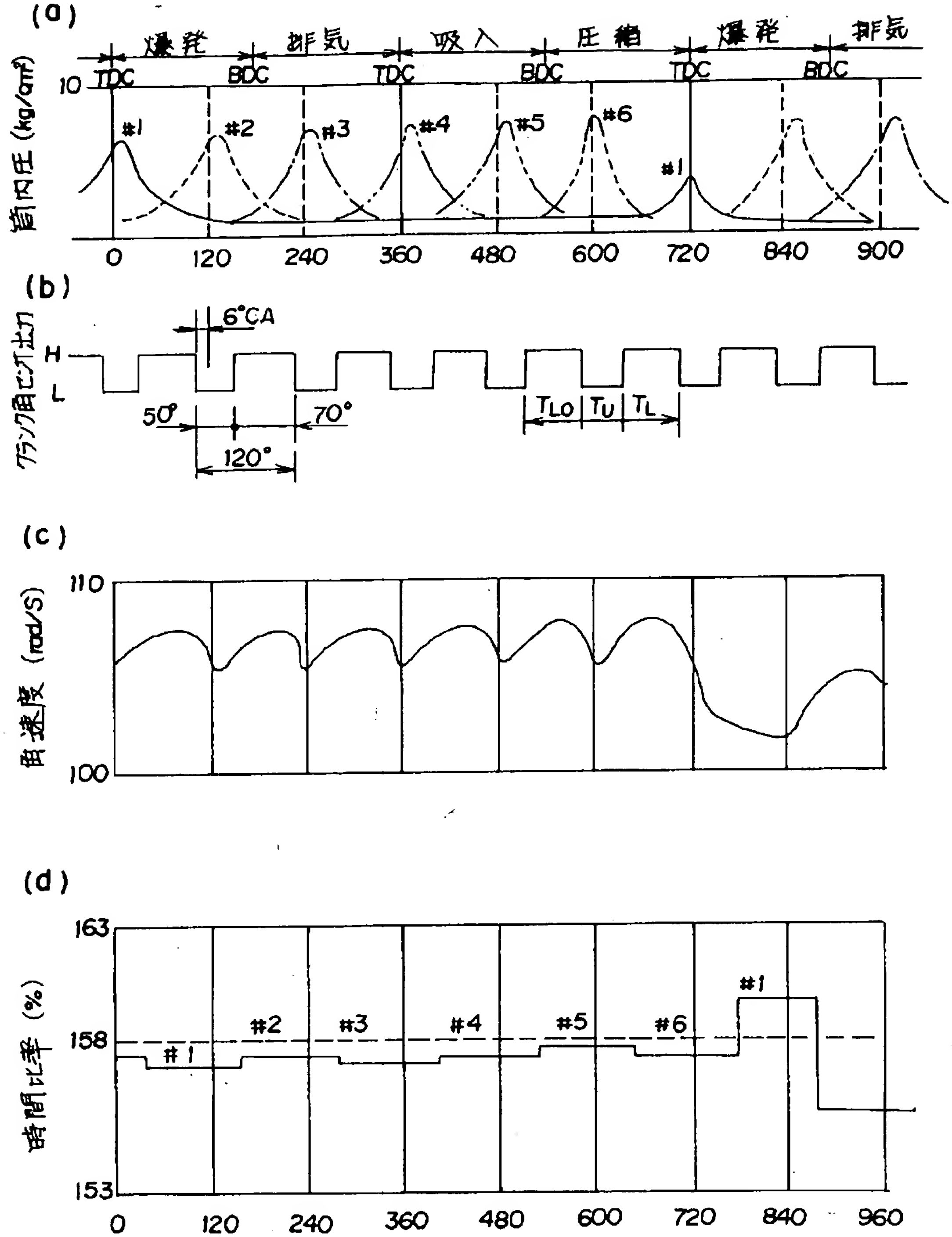
[Drawing 4]



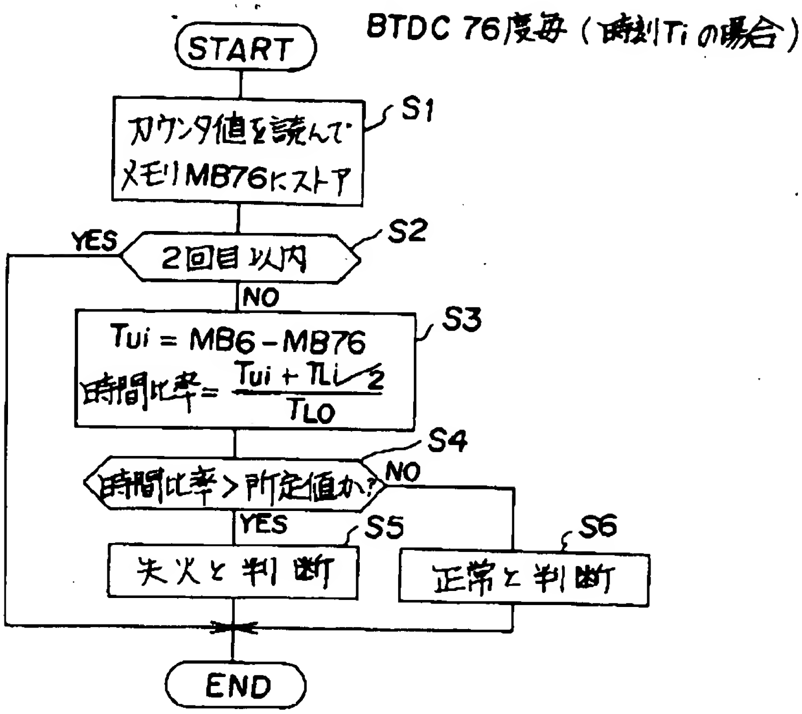
[Drawing 6]



[Drawing 3]


(a)
爆発
排気
吸入
圧縮
爆発
排気
TDC
BDC
TDC
BDC
TDC
BDC
筒内圧 (kg/cm²)
10
#1 #2 #3 #4 #5 #6 #1
0 120 240 360 480 600 720 840 900
(b)
クランク角センサ出力
H
L
6°CA
50°
70°
120°
TLO TU TL
(c)
角速度 (rad/S)
110
100
(d)
時間比率 (%)
163
158
153
#1 #2 #3 #4 #5 #6 #1
0 120 240 360 480 600 720 840 960

[Drawing 5]



[Translation done.]